

PROTOCOL

ECOLOGICAL SCREENING VALUES (ESVs)

Introduction

The following protocol has been developed to support the Savannah River Site (SRS) environmental remediation program. The ecological risk assessment (ERA), a component of the environmental remediation program, consists of identifying constituents that may adversely affect ecological receptors in the environment. Typically, this is accomplished by comparing abiotic concentrations at the site of interest with regulatory or technically defensible screening values. This protocol presents a comprehensive listing of non-radiological ecological screening values for surface water, sediment, and soil.

A listing of the ecological screening values that are proposed for the SRS remediation program are presented in Tables 1 – 3. These values are presented alphabetically for soil, sediment, and surface water.

Soil

Ecological screening values for soil are presented in Table 1. The EPA has not issued guidance values for soil. The available soil screening values are limited to those benchmarks issued by the Oak Ridge National Laboratory (ORNL) (Efroymson et al. 1997 a,b), and the Canadian (CCME 1998b) and Dutch (Crommentuijn 1997; MHSPE 1994) governments (WSRC 1998). The U.S. Fish and Wildlife Service (USFWS) (Beyer 1990) values are based on Dutch Ministry numbers issued in the 1980's (MHSPE 1994). The recommended soil screening values (Table 1) represent the lower or most conservative value with three exceptions: 1) when screening values from both USFWS (Beyer 1990) and Maximum Permissible Concentration (MPCs) (Crommentuijn 1997) are available, the latter is used; 2) when target values (MHSPE 1994) and MPCs (Crommentuijn 1997) are available, the latter is used; 3) if only an intervention value (MHSPE 1994) is available, it is divided by a factor of 10 to derive the recommended ESV (WSRC 1998).

Sediment

Ecological screening values for sediment are listed in Table 2. The preferred source used in this table is the most conservative EPA Region IV Screening Values (EPA 1995). If no EPA Region IV values were available, the most conservative value from EPA Ecotox Threshold screening values were used (EPA 1996). Other sources for values include benchmarks issued by the Canadian (CCME 1998a) and Dutch (MHSPE 1994) governments. For many constituents,

multiple sources for sediment screening values are few or unavailable. In some cases, only a single screening value is available. If the Dutch Ministry intervention value (MHSPE 1994) is the only available screening value, the value is divided by a factor of 10 to obtain the recommended value (WSRC 1998).

Surface water

Ecological screening values for surface water are presented in Table 3. The preferred ecological screening values for surface water are the chronic Region IV Ambient Water Quality (AWQ) values (EPA 1995). If AWQ values are not available, EPA Ecotox threshold (EPA 1996) values (i.e., final chronic values) are used. It should be noted that some Tier II values from Ecotox Thresholds (EPA 1996) are based on calculations by Suter and Mabrey (1994). When this occurs, the secondary chronic Tier II value (Suter and Tsao 1996) is used because it is more conservative and based on more recent data. If a screening value is not available from any of the three sources identified previously, the lowest chronic value or Canadian (CCME 1998c) benchmark is used.

Details

The approach described here is designed to support Step A of the ecological constituents of potential concern (COPC) selection process protocol. It should be noted that this protocol cannot be used until all data have been evaluated for compliance with data quality objectives (DQOs).

- A. Partition the data into the following media: surface water, sediment, or soil. All units of measurement should be included (i.e., mg/L, mg/kg, etc.).
- B. Determine the maximum concentration of each constituent.
- C. Compare the maximum concentration of the constituent with the appropriate ESVs in Table 1 (soil), Table 2 (sediment), or Table 3 (surface water).
- D. If the maximum value does not equal or exceed the ESV, the constituent is eliminated from further consideration in the ecological risk assessment. If the concentration of the constituent exceeds the ESV, the constituent is retained for further examination. If there is no ESV available for a constituent, it is also retained for further study in Step C of the ecological COPC selection process protocol.

References

Beyer, W.N. 1990. *Evaluation Soil Contamination*. United States Fish and Wildlife Service, Biological Report 90 (2).

CCME. 1998a. *Canadian Sediment Quality Guidelines*. Canadian Council of Ministers of the Environment, Winnipeg, Manitoba. (<http://www.ec.gc.ca/ceqg-rcqe/sediment.htm>)

CCME. 1998b. *Canadian Soil Quality Guidelines*. Canadian Council of Ministers of the Environment, Winnipeg, Manitoba. (<http://www.ec.gc.ca/ceqg-rcqe/soil.htm>)

CCME. 1998c. *Canadian Water Quality Guidelines*. Canadian Council of Ministers of the Environment, Winnipeg, Manitoba. (<http://www.ec.gc.ca/ceqg-rcqe/water.htm>)

Crommentuijn, T., D.F. Kalf, M.D. Polder, R. Posthumus, and E.J. van de Plassche. 1997. *Maximum Permissible Concentrations and Negligible Concentrations for metals, taking background concentration into account*. RIVM Report No. 601501001.

Efroymson, R.A., M.E. Will, and G.W. Suter. 1997a. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, TN. ES/ER/TM-126/R2. (<http://www.hrsd.ornl.gov/ecorisk/reports.html>).

Efroymson, R.A., M.E. Will, G.W. Suter, and A.C. Wooten. 1997b. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, TN. ES/ER/TM-95/R4. (<http://www.hrsd.ornl.gov/ecorisk/reports.html>).

EPA. 1995. *Supplemental Guidance to RAGS: Region 4 Bulletins Ecological Risk Assessment*. (<http://www.epa.gov/region4/wastepgs/oftecser/otsguid.htm>)

EPA. 1996. "Ecotox Thresholds". *ECO Update*, Office of Solid Waste and Emergency Response, Intermittent Bulletin Vol. 3, No. 2. EPA 540/F-95-038 PB95-963324. January 1996. (<http://www.epa.gov/superfund/oerr/r19/ecotox>).

EPA. 1998. *1998 Update of Ambient Water Quality Criteria for Ammonia*. August 1998.

MHSPE. 1994. *Intervention Values and Target Values – Soil Quality Standards*. Directorate-General for Environmental Protection, Department of Soil Protection, The Hague, The Netherlands. May 9, 1994.

Suter, G.W. and J.B. Mabrey. 1994. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota*. 1994 Revision. Oak Ridge National Laboratory, Oak Ridge, TN. ES/ER/TM-96/R1.

Suter, G.W. and C.L. Tsao. 1996. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota*. Oak Ridge National Laboratory, Oak Ridge, TN. ES/ER/TM-96/R2. (<http://www.hsrdoornl.gov/ecorisk/reports/html>)

WSRC, 1998. *Ecological Screening Values for Surface Water, Sediment, and Soil*, Draft, June 1998, Westinghouse Savannah River Company, Savannah River Site, Aiken, South Carolina.

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Ecological Screening Values (ESVs)**

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Table 1. Ecological Screening Values for Soil (mg/kg).

Constituent	TAL/ TCL ^a	U.S. Fish and Wildlife Service ^b			Oak Ridge National Laboratory			CCME ^j	Dutch Ministry Standards			ESV
		A ^c	B ^d	C ^e	Earthworms ^f	Micro- organisms ^f	Soil Phytoxicity ^g		Target Value ^k	Intervention Value ^k	MPC ^l	
Inorganics												
Aluminum	●					600	50					50
Antimony	●						5				3.5	3.5
Arsenic	●	20	30	50	60	100	10	12	29	55	34	10
Barium	●	200	400	2000		3000	500	500	200	625	165	165
Beryllium	●						10				1.1	1.1
Boron						20	0.5					0.5
Bromine		20	50	300			10					10
Cadmium	●	1	5	20	20	20	0.4	10	0.8	12	1.6	1.6
Calcium	●											
Chromium	●	100	250	8000	32 ^h	10	1	64	100	380	100	32
Cobalt	●	20	50	800		1000	20		20	240	33	20
Copper	●	50	100	500	50	100	100	63	36	190	40	40
Cyanide, free	●	1	10	100				0.9	1	2		0.9
Cyanide, complex	●	5	50	500								5
Cyanide complex (pH<5)	●								5	650		5
Cyanide complex (pH>5)	●								5	50		5
Fluorine					30	30	200					30
Iodine							4					4
Iron	●					200						200
Lanthanum						50						50
Lead	●	50	150	600	500	900	50	140	85	530	140	50
Lithium						10	2					2
Magnesium	●											
Manganese	●					100	500					100
Mercury (inorganic)	●	0.5	2	10	5 ⁱ	30	0.3	6.6	0.3	10	2.2	0.3
Molybdenum			10	40	200		200	2		10	200	254

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		A ^c	B ^d	C ^e	Earthworms ^f	Micro- organisms ^f	Soil Phyotoxicity ^g		Target Value ^k	Intervention Value ^k	MPC ^l			
1,2-Dichloroethylene (trans)	✓													
1,2-Dichloropropane	✓				700							700		
1,3-Dichlorobenzene	✓													
1,3-Dichloropropene	✓													
1,4-Dichlorobenzene	✓				20							20		
2,3,4,5-Tetrachlorophenol					20							20		
2,3,5,6-Tetrachloroaniline					20		20					20		
2,4,5-Trichloroaniline					20		20					20		
2,4,5-Trichlorophenol	✓				9		4					4		
2,4,6-Trichlorophenol	✓				10							10		
2,4-Dichloroaniline					100							100		
2,4-Dichlorophenol	✓													
2,4-Dimethylphenol	✓													
2,4-Dinitrophenol	✓						20					20		
2,4-Dinitrotoluene	✓													
2,6-Dinitrotoluene	✓													
2-Chloronaphthalene	✓													
2-Chlorophenol	✓													
2-Hexanone	✓													
2-Methyl-4,6-dinitrophenol	✓													
2-Methylnaphthalene	✓													
2-Nitrophenol	✓													
3,3'-Dichlorobenzidine	✓													
3,4-Dichloroaniline					20							20		
3,4-Dichlorophenol	✓				20		20					20		
3-Chloraniline					30		20					20		
3-Chlorophenol	✓				10		7					7		

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		A ^c	B ^d	C ^e	Earthworms ^f	Micro- organisms ^f	Soil Phyotoxicity ^g		Target Value ^k	Intervention Value ^k	MPC ^l			
4-Bromophenyl phenyl ether	✓													
4-Chloroaniline	✓													
4-Chloro-m-cresol	✓													
4-Chlorophenyl phenyl ether	✓													
4-Nitrophenol	✓				7						7			
-BHC	✓								0.0025		0.0025			
Acenaphthene	✓							20				20		
Acetone	✓													
-Chlordane	✓													
Acrylonitrile						1000						1000		
Aldrin	✓								0.0025			0.0025		
Aliphatic Chlorinated Hydrocarbons (each)		0.1	5	50								0.1		
Aliphatic Chlorinated Hydrocarbons (total)		0.1	7	70								0.1		
Anthracene	✓	0.1	10	100								0.1		
Atrazine									0.00005	6		0.00005		
-BHC	✓								0.001			0.001		
Benzene	✓	0.1	0.5	5					0.5	0.05	1	.05		
Benzidine	✓													
Benzo[a]anthracene	✓													
Benzo[a]pyrene	✓	0.1	1	10					0.7			0.1		
Benzo[b]fluoranthene	✓													
Benzo[g,h,i]perylene	✓													
Benzo[k]fluoranthene	✓													
Benzoic acid	✓													
Benzyl alcohol	✓													
Biphenyl							60					60		

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		A ^c	B ^d	C ^e	Earthworms ^f	Micro- organisms ^f	Soil Phyotoxicity ^g		Target Value ^k	Intervention Value ^k	MPC ^l			
Bis(2-chloroethoxy) methane	✓													
Bis(2-chloroethyl) ether	✓													
Bis(2-chloroisopropyl) ether	✓													
Bis(2-ethylhexyl)phthalate	✓													
Bromodichloromethane	✓													
Bromoform	✓													
Bromomethane (Methyl bromide)	✓													
Butylbenzyl phthalate	✓													
Carbaryl									5		0.5			
Carbofuran									2		0.2			
Carbon disulfide	✓													
Carbon tetrachloride	✓					1000					1000			
Catechol									20		2			
Chlorinated hydrocarbons		1	8	80							1			
Chloroacetamide					2						2			
Chlorobenzene (each)	✓	0.05	1	10							0.05			
Chlorobenzene (total)	✓	0.05	2	20	40				30		0.05			
Chloroethane	✓													
Chloroethene (Vinyl chloride)	✓													
Chloroform	✓													
Chloromethane (Methyl chloride)	✓													
Chloronaphthalene									10		1			
Chlorophenols (each)	✓	0.01	0.5	5							0.01			
Chlorophenols (total)	✓	0.01	1	10					10		0.01			
Chrysene	✓													
1,4-dichloro-2-butene (cis)						1000					1000			
1,4-dichloro-2-butene (trans)						1000								

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		A ^c	B ^d	C ^e	Earthworms ^f	Micro- organisms ^f	Soil Phyotoxicity ^g		Target Value ^k	Intervention Value ^k	MPC ^l			
Cresols (total)										5		0.5		
Cyclohexane		0.1	6	60								0.1		
Cyclohexanone									0.1	270		0.1		
-BHC	✓													
DDT/DDE/DDD (total)	✓							0.0025	4			0.0025		
Dibenz[a,h]anthracene	✓													
Dibenzofuran	✓													
Dibromochloromethane	✓													
Dichlorobenzene (total)	✓							0.01				0.01		
Dichloromethane (Methylene chloride)	✓								20			2		
Dichlorphenols (total)	✓							0.003				0.003		
Dieldrin	✓							0.0005				0.0005		
Diethyl phthalate	✓					100						100		
Dimethyl phthalate	✓				200							200		
Di-n-butyl phthalate	✓					200						200		
Di-n-octyl phthalate	✓													
Endosulfan I	✓													
Endosulfan II	✓													
Endosulfan sulfate	✓													
Endosulfan, mixed isomers	✓													
Endrin	✓							0.001				0.001		
Endrin ketone	✓													
Ethylbenzene	✓	0.05	5	50				0.7	0.05	50		0.7		
Ethylene glycol								960				960		
Fluoranthene	✓	0.1	10	100								0.1		
Fluorene	✓													
Furan							600					600		

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Table 1. Ecological Screening Values for Soil (mg/kg).

Constituent	TAL/ TCL ^a	U.S. Fish and Wildlife Service ^b			Oak Ridge National Laboratory			CCME ^j	Dutch Ministry Standards			ESV
		A ^c	B ^d	C ^e	Earthworms ^f	Micro- organisms ^f	Soil Phyotoxicity ^g		Target Value ^k	Intervention Value ^k	MPC ^l	
Organochlorinated Pesticides (each)		0.1	0.5	5								0.1
Organochlorinated Pesticides (total)		0.1	1	10								0.1
DDD	✓											
DDE	✓											
DDT	✓							0.7				0.7
PAHs (total)		1	20	200					1	40		1
PCB 1016	✓											
PCB 1221	✓											
PCB 1232	✓											
PCB 1242	✓											
PCB 1248	✓											
PCB 1254	✓											
PCB 1260	✓											
PCBs (total)	✓	0.05	1	10				40	0.3	0.02	1	0.02
p-Cresol (4-Methylphenol)	✓											
Pentachloroaniline					100							100
Pentachlorobenzene					20					0.0025		0.0025
Pentachlorophenol	✓				6	400	3	7.6	0.002			0.002
Pesticides (total)		0.1	2	20								0.1
Phenanthrene	✓	0.1	5	50								0.1
Phenol	✓	0.02	1	10	30	100	70	3.8	0.05	40		0.02
Phthalates (total)										0.1	60	0.1
p-Nitroaniline	✓											
Pyrene	✓	0.1	10	100								0.1
Pyridine		0.1	2	20						0.1	1	0.1
Resorcinol											10	1
Styrene	✓	0.1	5	50				300		0.1	100	0.1

Table 1. Ecological Screening Values for Soil (mg/kg).

Constituent	TAL/ TCL ^a	U.S. Fish and Wildlife Service ^b			Oak Ridge National Laboratory			CCME ^j	Dutch Ministry Standards			ESV
		A ^c	B ^d	C ^e	Earthworms ^f	Micro- organisms ^f	Soil Phyotoxicity ^g		Target Value ^k	Intervention Value ^k	MPC ^l	
Tetrachlorobenzenes (total)									0.01			0.01
Tetrachloroethylene	✓							0.2	0.01	4		0.01
Tetrachloromethane									0.001	1		0.001
Tetrachlorophenols (total)									0.001			0.001
Tetrahydrofuran		0.1	4	40					0.1	0.4		0.1
Tetrahydrothiophene		0.1	5	50					0.1	90		0.1
Toluene	✓	0.05	3	30			200	0.8	0.05	130		0.05
Toxaphene	✓											
Trichlorobenzenes (total)	✓								0.01			0.01
Trichloroethylene	✓							3	0.001	60		0.001
Trichloromethane (Chloroform)									0.001	10		0.001
Trichlorophenols (total)									0.001			0.0001
Vinyl acetate	✓											
Vinyl chloride										0.1		0.01
Xylenes (total)	✓	0.05	5	50								0.05

a- TAL/TCL designation: ●=TAL; ✓ =TCL.

b- Beyer (1990).

c- A-refers to background concentrations in soil or detection limits.

d- B-refers to moderate soil contamination that requires additional study.

e- C-refers to threshold values that require immediate cleanup.

f- Efroymson et al. (1997a).

g- Efroymson et al. (1997b).

h- Value is for Chromium III.

i- Mercury value taken from Eisler (1987).

j- CCME (1998b).

k- MHSPE (1994).

l- Crommentuijn et al. (1997).

Table 2. Ecological Screening Values for Sediment (mg/kg).

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Table 2. Ecological Screening Values for Sediment (mg/kg).

Constituent	TAL/ TCL ^a	EPA Region IV ^b			Ecotox Thresholds ^c			Environment Canada ^f		Dutch Ministry Standards ⁱ		ESV
		Effects Values	CLP Practical Quantitation Limit	Screening Value	EPA Sediment Quality ^d	EPA Sediment Quality Benchmark ^e	Effects Range- Low	TEL ^g	PEL ^h	Target Value	Intervention Value	
2,4-Dinitrophenol	✓											
2,4-Dinitrotoluene	✓											
2,6-Dinitrotoluene	✓											
2-Chloronaphthalene	✓											
2-Chlorophenol	✓											
2-Hexanone	✓											
2-Methyl-4,6-dinitrophenol	✓											
2-Methylnaphthalene	✓	0.02	0.330	0.330				0.02	0.201			0.33
2-Nitrophenol	✓											
3,3'-Dichlorobenzidine	✓											
4-Bromophenyl phenyl ether	✓					1.3						1.3
4-Chloroaniline	✓											
4-Chloro-m-cresol	✓											
4-Chlorophenyl phenyl ether	✓											
4-Nitrophenol	✓											
Acenaphthene	✓	0.007	0.330	0.330	0.620			0.016	0.0067	0.089		0.330
Acenaphthylene	✓	0.0059	0.330	0.330					0.0059	0.128		0.330
Acetone	✓											
Aldrin	✓									0.0025		0.0025
Anthracene	✓	0.047	0.330	0.330				0.047	0.245			0.330
Atrazine										0.00005	6.0	0.00005
Benzene	✓					0.057				50	1000	0.057
Benzidine	✓											
Benzo[a]anthracene	✓	0.075	0.330	0.330				0.032	0.385			0.330
Benzo[a]pyrene	✓	0.089	0.330	0.330			0.430	0.032	0.782			0.330

Table 2. Ecological Screening Values for Sediment (mg/kg).

Constituent	TAL/ TCL ^a	EPA Region IV ^b			Ecotox Thresholds ^c			Environment Canada ^f		Dutch Ministry Standards ⁱ		ESV
		Effects Values	CLP Practical Quantitation Limit	Screening Value	EPA Sediment Quality ^d	EPA Sediment Quality Benchmark ^e	Effects Range-Low	TEL ^g	PEL ^h	Target Value	Intervention Value	
Benzo[b]fluoranthene	✓											
Benzo[g,h,i]perylene	✓											
Benzo[k]fluoranthene	✓											
Benzoic acid	✓											
Benzyl alcohol	✓											
-BHC	✓									0.0025		0.0025
-BHC	✓									0.001		0.001
-BHC	✓											
-BHC (Lindane)	✓	0.00032	0.0033	0.0033		0.0037		0.00094	0.0027	0.00005		0.0033
Biphenyl						1.1						1.1
Bis(2-chloroethoxy) methane	✓											
Bis(2-chloroethyl) ether	✓											
Bis(2-chloroisopropyl) ether	✓											
Bis(2-ethylhexyl)phthalate	✓	0.182	.0036	0.182								0.182
Bromodichloromethane	✓											
Bromoform	✓											
Bromomethane (Methyl bromide)	✓											
Butylbenzyl phthalate	✓					11.0						11.0
Carbaryl										5		0.500
Carbofuran										2		0.200
Carbon disulfide	✓											
Carbon tetrachloride	✓											
Catechol										20		2
Chlordane	✓	0.0005	0.0017	0.0017				0.0045	0.0089			0.0017

Table 2. Ecological Screening Values for Sediment (mg/kg).

Constituent	TAL/ TCL ^a	EPA Region IV ^b			Ecotox Thresholds ^c			Environment Canada ^f		Dutch Ministry Standards ⁱ		ESV
		Effects Values	CLP Practical Quantitation Limit	Screening Value	EPA Sediment Quality ^d	EPA Sediment Quality Benchmark ^e	Effects Range-Low	TEL ^g	PEL ^h	Target Value	Intervention Value	
PCB 1248	✓											
PCB 1254	✓											
PCB 1260	✓											
PCBs (total)	✓	0.022	0.067	0.067			0.023	0.034	0.277	0.020	1	0.067
Pentachlorobenzene						0.690				0.0025		0.690
Pentachlorophenol	✓									0.002		0.002
Phenanthrene	✓	0.087	0.330	0.330	0.850		0.240	0.042	0.515			0.330
Phenol	✓									0.050	40	0.050
Phthalates (total)										0.100	60	0.100
p-Nitroaniline	✓											
Pyrene	✓	0.153	0.330	0.330			0.660	0.053	0.875			0.330
Pyridine										0.100	1	0.100
Resorcinol											10	1
Styrene	✓									0.100	1	0.100
Tetrachlorobenzenes (total)										0.010		0.010
Tetrachloroethene	✓				0.530					0.010	4	0.530
Tetrachloromethane					1.2					0.001	1	1.2
Tetrachlorophenols (total)										0.001		0.001
Tetrahydrofuran										0.100	0.400	0.100
Tetrahydrothiophene										0.100	90	0.100
Toluene	✓				0.670							0.670
Toxaphene	✓				0.028		0.0015			0.050	130	0.028
Tribromomethane					0.650							0.650
Trichlorobenzenes (total)	✓									0.010		0.010

Table 2. Ecological Screening Values for Sediment (mg/kg).

Constituent	TAL/ TCL ^a	EPA Region IV ^b			Ecotox Thresholds ^c			Environment Canada ^f		Dutch Ministry Standards ⁱ		ESV
		Effects Values	CLP Practical Quantitation Limit	Screening Value	EPA Sediment Quality ^d	EPA Sediment Quality Benchmark ^e	Effects Range-Low	TEL ^g	PEL ^h	Target Value	Intervention Value	
Trichloroethene	✓					1.6				0.001	60	1.6
Trichloromethane										0.001	10	0.001
Trichlorophenols (total)										0.001		0.001
Vinyl acetate	✓											
Vinyl chloride										0.100		0.010
m-Xylene	✓					0.025						0.025
Xylenes (total)	✓									0.050	25	0.050

a- TAL/TCL designation: ●=TAL; ✓ =TCL.

b- EPA (1995).

c- EPA (1996).

d- Values assume 1% organic carbon and are the lower limit of the 95% confidence interval.

e- Sediment Quality Benchmarks by equilibrium partitioning (assumes 1% organic carbon).

f- CCME (1998a).

g- Threshold Effects Level.

h- Probable Effects Level.

i- MHSPE (1994).

Table 3. Ecological Screening Values for Surface Water ($\mu\text{g/L}$).

Constituent	TAL / TCL ^a	AWQ values ^b		Ecotox Thresholds ^e		ORNL Tier II ^h		ORNL ^h Lowest Chronic Value for:					CCME ⁱ	ESV
		Acute	Chronic	AWQC ^f or FCV ^g	Tier II	Secondary Acute	Secondary Chronic	Fish	Daphnids	Invertebrates	Aquatic Plants	All Organisms		
Inorganics														
Aluminum	●	750 ^c	87 ^c					3288	1900		460	460	5-100	87
Ammonia		8400 ^d	1270 ^d					1.7	630		2400	1.7	1370-2200	1270
Antimony	●	1300	160			180	30	1600	5400		610	610		160
Arsenic	●												2.2	2.2
Arsenic III	●	360	190	190				2962	914		2320	914		190
Arsenic V	●				8.1	66	3.1	892	450		48	48		3.1
Barium	●				3.9	110	4							3.9
Beryllium	●	16	0.53			35	0.66	57	5.3		100000	5.3		0.53
Boron			750		5.1	30	1.6		8830			8830		750
Cadmium	●	1.79 ^j	0.66 ^j	1				1.7	0.15		2	0.15	0.017	0.66
Calcium	●								116000			116000		116000
Chloride		860000	230000											230000
Chlorine (Total Residue)		19	11											11
Chromium III	●	984.32 ^j	117.32 ^j	180				69	<44		397	<44	8.9	117.32
Chromium VI	●	16	11	10				73.2	6.1		2	2	1.0	11
Cobalt	●			3	1500	23		290	5.1			5.1		3
Copper	●	9.22 ^j	6.54 ^j	11				3.8	0.23	6.07	1	0.23	2-4	6.54
Cyanide	●	22	5.2	5.2				7.8		18.3	30	7.8	5	5.2
Iron	●		1000	1000				1300	158			158	300	1000
Lead	●	33.78 ^j	1.32 ^j	2.5				18.9	12.3	25.5	500	12.3	1-7	1.32
Lithium					260	14								14
Magnesium	●								82000			82000		82000
Manganese	●			80	2300	120		1780	<1100			<1100		80
Mercury (inorganic)	●	2.4	0.012	1.3			1.36	<0.23	0.96		5	<0.23		0.012

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Constituent	TAL / TCL ^a	AWQ values ^b		Ecotox Thresholds ^e		ORNL Tier II ^h		ORNL ^h Lowest Chronic Value for:					CCME ⁱ	ESV
		Acute	Chronic	AWQC ^f or FCV ^g	Tier II	Secondary Acute	Secondary Chronic	Fish	Daphnids	Invertebrates	Aquatic Plants	All Organisms		
Anthracene	✓					13	0.73	0.09	<2.1		0.09	0.012	0.73	
Atrazine												1.8	1.8	
Benzene	✓	530	53	46		2300	130	>98000		525000	525000	370	53	
Benzidine	✓	250	25			70	3.9	134			134		25	
Benzo[a]anthracene	✓					0.49	0.027		0.65		0.65	0.018	0.027	
Benzo[a]pyrene	✓				0.014	0.24	0.014		0.3		0.3	0.015	0.014	
Benzo[b]fluoranthene	✓													
Benzo[g,h,i]perylene	✓													
Benzo[k]fluoranthene	✓													
Benzoic acid	✓					740	42	12976			12976		42	
Benzyl alcohol	✓					150	8.6	589			589		8.6	
-BHC	✓		500										500	
-BHC	✓		5000										5000	
-BHC	✓													
-BHC (Lindane)	✓	0.95 c	0.08	0.08				14.6	14.5	3.3	500	3.3	0.08	
BHC (Other)	✓					39	2.2	95			95		2.2	
Biphenyl					14		14						14	
Bis(2-chloroethoxy) methane	✓													
Bis(2-chloroethyl) ether	✓	23800	2380										2380	
Bis(2-chloroisopropyl) ether	✓													
Bis(2-ethylhexyl)phthalate	✓	1110	<0.3		32	27	3	912		912			<0.3	
Bromocil												5.0	5.0	
Bromodichloromethane	✓													
Bromoform	✓	2930	293		320	2300	320						293	
Bromomethane (Methyl bromide)	✓	1100	110										110	
Bromoxynil												5.0	5.0	
Butylbenzyl phthalate	✓	330	22		19		19						22	

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Constituent	TAL / TCL ^a	AWQ values ^b		Ecotox Thresholds ^e		ORNL Tier II ^h		ORNL ^h Lowest Chronic Value for:					CCME ⁱ	ESV
		Acute	Chronic	AWQC ^f or FCV ^g	Tier II	Secondary Acute	Secondary Chronic	Fish	Daphnids	Invertebrates	Aquatic Plants	All Organisms		
Dibenz[a,h]anthracene	✓													
Dibenzofuran	✓			20		66	3.7					1003		3.7
Dibromochloromethane	✓													
Dicamba													10	10
Dichlorobenzene (total)	✓													
Dichloromethane (Methylene chloride)	✓	193000	1930			26000	2200	108000	42667			42667	98.1	1930
Dichlorphenols (total)	✓												0.2	0.2
Diclofop-methyl													6.1	6.1
Dieldrin	✓	0.24	0.056	0.062										0.056
Diethyl phthalate	✓	5210	521		220	1800	210				85600	85600		521
Dimethoate													6.2	6.2
Dimethyl phthalate	✓	3300	330											330
Di(2-ethylhexyl) phthalate													16	16
Di-n-butyl phthalate	✓	94	9.4		33	190	35	717	697			697	19	9.4
Di-n-octyl phthalate	✓							3822	708			708		708
Dinoseb													0.05	0.05
Dioxin (2,3,7,8-TCDD)		0.1	1E-05											0.00001
Endosulfan I	✓	0.22	0.056		0.051		0.051						0.02	0.056
Endosulfan II	✓	0.22	0.056		0.051		0.051						0.02	0.056
Endosulfan sulfate	✓													
Endosulfan, mixed isomers	✓													
Endrin	✓	0.18	0.0023	0.061										0.0023
Endrin ketone	✓													
Ethylbenzene	✓	4530	453		290	130	7.3	>440	12922		>438000	>440	90	453
Ethylene glycol													192000	192000
Fluoranthene	✓	398	39.8	8.1				30	15		54400	15	0.04	39.8
Fluorene	✓				3.9	70	3.9						3	3.9

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Constituent	TAL / TCL ^a	AWQ values ^b		Ecotox Thresholds ^e		ORNL Tier II ^h		ORNL ^h Lowest Chronic Value for:					CCME ⁱ	ESV
		Acute	Chronic	AWQC ^f or FCV ^g	Tier II	Secondary Acute	Secondary Chronic	Fish	Daphnids	Invertebrates	Aquatic Plants	All Organisms		
Oil & Grease			0.01											0.01
Parathion			0.065	0.013										0.013
PCB 1016	✓	0.2	0.014											0.014
PCB 1221	✓	0.2	0.014			5	0.28	60			60			0.014
PCB 1232	✓	0.2	0.014			10	0.58	124			124			0.014
PCB 1242	✓	0.2	0.014			1.2	0.053	9	4.9	300	4.9			0.014
PCB 1248	✓	0.2	0.014			1.4	0.081							0.014
PCB 1254	✓	0.2	0.014			0.6	0.033		2.9		0.1	0.1		0.014
PCB 1260	✓	0.2	0.014			1700	94	<1.3			2.3			0.014
PCBs (total)	✓				0.19		0.14	0.2	2.1	0.8	0.144	0.1		0.14
Pentachlorobenzene		250	50		0.47	8.4	0.47						6	50
Pentachlorophenol	✓	19	15	13									0.5	15
Phenanthrene	✓			6.3				200			200	0.4		6.3
Phenol	✓	1020	256					<200	2005	20000	<200			256
Phenols (mono- & dihydric)													4	4
Phenoxy herbicides													4	4
Picloram													29	29
p-Nitroaniline	✓													
Propylene glycol													500000	500000
Pyrene	✓												0.025	0.025
Quinoline													3.4	3.4
Simazine													10	10
Styrene	✓												72	72
Tebuthiuron													1.6	1.6
Tetrachloroethene	✓	528	84		120	830	98	840	750	>816000	750	111		84
Tetrachloromethane					240	4400	240						13.3	240
Tetrachlorophenols													1	1

Table 3. Ecological Screening Values for Surface Water ($\mu\text{g/L}$).

Constituent	TAL / TCL ^a	AWQ values ^b		Ecotox Thresholds ^e		ORNL Tier II ^h		ORNL ^h Lowest Chronic Value for:					CCME ⁱ	ESV
		Acute	Chronic	AWQC ^f or FCV ^g	Tier II	Secondary Acute	Secondary Chronic	Fish	Daphnids	Invertebrates	Aquatic Plants	All Organisms		
Toluene	✓	1750	175		130	120	9.8	1263	25229	245000	1269	2	175	
Toxaphene	✓	0.73	0.0002		0.011									0.0002
Triallate													0.24	
Tributyltin		0.46 c	0.063 c										0.008	0.063
Trichloroethylene	✓				350	440	47	11100	7257		7257	21	47	
Trichlorophenols													18	18
Trifluralin													0.2	0.2
Triphenyltin													0.022	0.022
Vinyl acetate	✓					280	16	810			810			16
m-Xylene	✓				1.8	32	1.8							1.8
Xylene	✓					230	13	62308			62308			13

a- TAL/TCL designation: ●=TAL; ✓ =TCL.

b- Region IV Ambient Water Quality Values (EPA 1995) unless otherwise noted.

c- pH 6.5-9.0.

d- Ammonia is pH dependent. The value if from the 4-day average chronic concentration in water having a pH of 8.0 when salmonids and other sensitive coldwater species are absent (EPA 1998).

e-EPA (1996)

f- Ambient Water Quality Criteria (EPA 1996).

g- Final Chronic Value (EPA 1996).

h- Suter and Tsao (1996).

i- CCME (1998c).

j- Hardness Dependent Based on the following equations:

Compound	Acute Screening Value	Chronic Screening Value
Cadmium	$e^{(1.128(\ln H)-3.828)}$	$e^{(0.7825(\ln H)-3.49)}$
Chromium III	$e^{(0.819(\ln H)+3.688)}$	$e^{(0.819(\ln H)+1.561)}$
Copper	$e^{(0.9422(\ln H)-1.464)}$	$e^{(0.8545(\ln H)-1.465)}$

Table 3. Ecological Screening Values for Surface Water ($\mu\text{g/L}$).

Lead	$e^{(1.273(\ln H)-1.46)}$	$e^{(1.273(\ln H)-4.705)}$
Nickel	$e^{(0.846(\ln H)+3.3612)}$	$e^{(0.846(\ln H)+1.1645)}$
Silver	$e^{(1.72(\ln H)-6.52)}$	
Zinc	$e^{(0.8473(\ln H)+0.8604)}$	$e^{(0.8473(\ln H)+0.7614)}$